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A Journal Devoted to the Problems of Capital Investment

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THE YUGOSLAV SYSTEM OF INVESTMENT FINANCING AND THE APPLICATION OF CRITERIA IN THE SELECTION OF INVESTMENT PROJECTS

By Filip Vasic
Director of the Economic Research Department
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In the period following the end of the Second World War, and up to 1952, the Yugoslav economic system possessed all the features of a highly-centralized planned economy. This was a consequence of the production relationships which resulted from the victory of socialist forces in Yugoslavia at that time. In the period 1950-52, however, the foundations of a new economic system were laid, as a result of some radical changes in the Yugoslav social system as a whole. The new economic system laid the main stress (1) on the decentralization of functions in economic management and (2) on the autonomy of the management of enterprises and communes, and on leaving scope for free economic initiative to them. Within the framework of these changes in the economic system as a whole, the system of investment financing also underwent considerable modification. Up to that time, the Yugoslav system of investment financing had been based on centralized planning, not only of aggregate categories of investments, but also of individual projects. The financing was effected by means of allocations out of the budget, without obligation of repayment. Investment finance positions were foreseen in the Federal, republican and local budgets, but the share of investment finance allocated through the Federal budget was by far the largest. The banks, at that time, acted as distributors of investment resources and had, in addition, certain control functions authorizing them to supervise the ways in which these resources were being spent.

In order to form an idea about the essential characteristics of investment financing in Yugoslavia, it is absolutely necessary to get acquainted, at least to some extent, with the basic features of the Yugoslav economic system. Within this system, economic planning is conjoined with the allowance of free initiative for economic groups (socialist enterprises, communes and other bodies incorporated in the social and economic life of the country). The plan forecasts

the basic pace and general pattern of future economic development and the main proportions of the distribution of income, and, in addition, provides for the introduction of measures necessary to maintain economic stability while achieving the maximum possible rate of growth.

The major part of the resources needed to assure a given rate of economic growth (for investments of the social sector) is drawn out of accumulation realized in the social sector of the economy. That is to say, the resources required to cover general needs and investment finance are obtained by means of imposing taxes on the incomes of enterprises. Thus, a reliable basis has been formed for the distribution of the national income among the main aggregate categories (personal consumption, collective consumption and investments).

Within this broadly-set plan, the enterprises are given plenty of opportunities for a free development of their business activity. The enterprises obtain, from the community as a whole, the necessary fixed assets and working capital, and are left to manage these resources according to their own free judgment, being completely free to engage such other production factors as they see fit. The plan does not contain even the slightest instruction to the enterprises as to what and how much they should produce. The income of the enterprise (which is obtained when the material cost, depreciation allowances, interest on the funds of fixed assets and working capital, and the turnover tax are deducted from the total proceeds realized by it) is taxed in accordance with existing regulations.* The rate of taxation is progressive and the rate of progression is made dependent upon the ratio of its income to the total sum of guaranteed minimum wages and salaries that the enterprise has to pay to its workers and employees. The smaller the share of these minimum wages and salaries in the income, the greater is the rate of taxation. Revenues from these taxes are divided between the Federation, on the one hand, and the republican and local authorities, on the other. The share of revenue which goes to the Federation is

*Note that these costs do not include labor. Ed.

used to cover the general needs of the community as a whole; a part of it (which is fixed in the social plan) is channeled to the General Investment Fund -- the investment fund of the Federation. All such receipts from taxes on the incomes of enterprises as are allocated to republican and local authorities are directed to their investment funds. The share of income remaining at the disposal of the enterprise after taxes (net income) is split between the payment of wages and salaries and the replenishment of funds (reserve fund and investment funds). Thus, with this primary distribution of income accruing to the economy, the major part of resources needed for investment purposes is assured, both in social investment funds and in those of the enterprises.

INVESTMENT RESOURCES

Investment resources may be divided into two main categories: resources of the community as a whole, comprising social resources at various levels of government, and own resources of enterprises -- that is, resources at the free disposal of each enterprise.

The resources of the community as a whole are held in these forms:

a) Social investment funds, on the Federal, republican and local authority level. The main source of receipts going to these funds is the share of revenue from the above mentioned taxes on the income of enterprises, but this is not their only source. As a rule, investment loans for investment in economic projects are given out of these funds, and only exceptionally are investment grants made out of them without obligation of repayment and for strictly defined purposes (construction of roads and railway track, etc.).

b) Special social funds are utilized for purposes determined in advance, such as: advancement of certain sectors of the economy, road and waterway maintenance, exploitation of forests, etc. The receipts of these funds come from different sources, but mostly out of budget grants, or from the ceding of certain tax revenues. Investment financing out of special social funds is done in the form of grants without obligation of repayment.

c) Budget resources utilized for non-economic investments (social overhead): schools, cultural institutions, health protection and social security projects, sports projects, administrative office buildings, etc.

d) Housing funds, which are funds for the financing of housing development by means of loans. To these funds is directed the part of the revenue from the tax on the income of enterprises corresponding to 4 per cent of the wages and salaries paid by each enterprise. Housing funds grant loans for the construction of dwellings

to enterprises, housing associations and individual investors.

The resources of an enterprise may be divided into the following components:

a) Depreciation allowances. These resources are kept on a special account of the enterprise and may be used by it under certain specified conditions. That is, a certain percentage of the paid-in depreciation allowances, the level of which depends upon the branch of activity to which the enterprise belongs and on the level of working life of its fixed assets, is blocked and the enterprise is not allowed to use it.

b) Other investment resources at the disposal of the enterprise, originating from that part of its income which remains at its disposal after taxes. After having distributed a part of its income as wages and salaries, the enterprise allocates the rest of it to its own funds -- the reserve fund and the two investment funds, one of which serves for economic investments and the other for investments in social overhead, that is, for projects aimed at the improvement of the social standard (housing for the workers and employees of the enterprise, sports projects, social security projects, etc.).

To give an idea of the size of certain categories of investment resources and of their interrelations, the receipts of investment resources in the last three years are shown below, divided by categories:

(In billions of dinars)	1957		1958		1959	
	Amt.	%	Amt.	%	Amt.	%
Social Investment Funds	228.3	40.2	286.5	42.8	339.8	43.2
Special Investment Funds	34.6	6.1	24.2	3.6	33.1	4.2
Budget Resources	19.0	3.3	28.8	4.3	40.0	5.1
Housing Funds	53.0	9.3	64.4	9.7	77.4	9.8
Government Bodies, Institutions, etc.	30.2	5.3	29.6	4.4	36.5	4.6
Enterprises	203.3	35.8	235.9	35.2	260.6	33.1
Total	568.4	100.0	669.4	100.0	787.4	100.0
Of Which:						
Resources at the Free Disposal of Enterprises	70.7	12.4	100.0	14.9	122.2	15.5
Depreciation Allowances	132.6	23.4	135.9	20.3	138.4	17.6

The resources of social investment funds are the most important, both from the point of view of their volume and also of the purposes for which they are used. As a rule, investment loans out of these funds are granted on the basis of competitive biddings. At the lowest

level, however, -- that of the local authorities' social investment funds (those of districts and communes) -- the number of prospective investors is sometimes so insignificant that the organization of competitive biddings becomes superfluous. When investment loans are being granted out of the General Investment Fund -- and partly also out of republican funds -- their approval is tied to the participation of the prospective investor, be it an enterprise or a people's committee, in the provision of required investment resources. By the decision of the bank, the share of investor's participation, or the percentage of the total cost estimate which should be covered by that share of participation, is fixed by the decision of the bank. Only for certain specific kinds of projects (power plants, power transmission lines, railway track, etc.) is the participation of investors with their own investment resources not required. Generally speaking, the excess of investment outlays, over and above the level foreseen in the investment program on the basis of which the investment loan is being granted, should be covered out of the investor's own resources or by his guarantor, the only exception being made in the cases when the excess above the estimated cost is the result of general price increases. For every loan granted by it, the bank has the right to demand a guarantee from the competent communal, district or republican authorities. By granting such guarantees, the communal, district or republican organ concerned assumes a formal obligation to cover excess expenditure and pay the annual installments of loan repayment, should the investor be unable to do this out of his own resources. In addition to this official guarantee, there exists the obligation of guarantee deposits, in the amount of 5 per cent of the loan sum, which are used to cover eventual liabilities arising out of the investor's failure to pay the excess of project cost or the first installment of loan repayment.

As we have said above, investment loans are granted on the basis of competitive biddings. Exception to this rule is made in the case of certain projects, as, for instance, large power plants, roads, railway track -- which are specified in the social plan.

Competitive biddings may be organized either for investments in a given branch of economic activity, as, for example, sugar refineries, cellulose and paper mills, brick factories, cement plants, etc.; or

for investments in modernization projects in general, without reference to individual branches of production. The social plans (Federal, republican and local) set the global proportions of resources to be engaged for certain purposes, and the banks organize competitive biddings for the financing of projects within the limits of these proportions. Prospective investors -- either enterprises, when expansion or modernization of existing productive capacities is involved, or people's committees, when new enterprises are being created -- send in their investment programs comprising detailed technical and economic documentation in respect of construction cost and expected results. The bank submits these investment programs to a detailed scrutiny. After this, a proposal is made to the Board of Directors of the Bank to grant loans, within the total amounts of available resources, to those prospective investors whose projects promise the most favorable results.

When making proposals for the granting of loans, the Bank is guided by a number of criteria. In the Decree on Investments certain criteria are mentioned exempli causa, but no order of priority is specified there. For every competitive bidding, criteria are outlined depending upon the situation prevailing at that time, upon the current economic policy, and upon the specific importance of certain branches of the economy; the priority order of these criteria is drawn up, and sometimes, also, minimum conditions are set.

The following criteria are enumerated in the Decree on Investments: the rate of interest, the level of own participation in investment outlays, the repayment term for the loan, the term within which the construction is to be completed, the most attractive profitability ratio, the ratio of investment per unit of output, the foreign exchange effect of the given investment.

As already mentioned, the criteria have not been listed here by order of priority. The priority order, both for criteria which are mentioned above and for any other eventual criteria, is set in the decision on the organization of the given competitive bidding. Thus, for example, in the decision on the organization of the competitive bidding for projects of expansion and modernization of the existing, and the building of new, sugar refineries, it is provided

that prospective investors fulfulling the following conditions will be given priority:

1. The most favorable conditions for the supply of needed raw materials, and, as a consequence, the lowest cost per unit of sugar output.

2. The largest volume of total production of sugar in relation to the amount of invested resources.

3. The largest own participation in investment outlays over and above the prescribed percentage.

4. The shortest period, from the moment of the granting of the investment loan, within which the normal run of the new capacities could be started.

5. The shortest term of loan repayment.

The first criterion was of decisive importance in this case. The main selection among the submitted investment programs was made on the basis of the availability of sources of raw materials (sugar beet production), as the cost of sugar-beet transport is an important component of the production cost. The importance of the other criteria emerges successively, so that the selection was made by taking into consideration , first, the more important criteria, and then those which in the given case may be considered as less important.

In another case. which concerned the organization of a competitive bidding for paper-mill projects, criteria were set up in the following order of priority:

1. Production cost per unit of output.

2. Profitability (ratio of the income of the enterprise to the investment outlays made by it).

3. Profitability from the point of view of the loan (ratio of the income of the enterprise to the amount of the investment loan). As the participation of the enterprise in the investment may be larger or smaller, but not below the prescribed minimum percentage, this ratio may be more or less favorable than the criterion described under 2 above.

4. Cost of investment per unit of output.

5. Amount of loan needed per unit of output.

In this case, there is no significant difference between the importance of individual criteria, as was the case in the first example, although, of course, the order of priority is the order according to which criteria are listed in this case. The selection of projects was made while taking into account all the above listed

criteria, a somewhat greater importance being, however, attached to the first-listed criteria.

The foreign-exchange effect was not taken into consideration in either of the above mentioned examples. The reason for this is that in both cases the projects referred to production for domestic needs, so that exports were not being reckoned with.

When competitive biddings are organized for modernization projects in general, and not for certain specific branches of the economy, as was the case with the examples quoted above, only two criteria are accepted, as a rule: profitability -- that is, the ratio of the income of the enterprise to the amount of investment outlays -- and the foreign-exchange effect, which is expressed as the ratio of net receipts of foreign exchange to total investment outlays. (It should be noted here that net receipts are mainly the result of an increase in exports or a decrease in imports as active items, and of imports of raw materials and semi-finished goods and depreciation allowances for imported capital goods, as passive items.) Usually, minimum conditions are set in such cases, which should be satisfied in the investment projects. In addition to the minimum rate of profitability and the foreign-exchange effect, conditions are also prescribed as regards the length of the construction period and/or the period within which the normal run of the new capacity is to be started.

The system of the selection of investment projects is still undergoing analysis with a view to its eventual further perfection. As compared with the methods applied in the selection of projects immediately after the introduction of the system of competitive biddings, it has already been greatly improved. Still, however reliable may be the methods for foreseeing the returns to be expected from an investment outlay, a certain degree of uncertainty on this count is always present; thus, it is only possible to tend towards some ideal,entirely objectivized criteria, bearing in mind, at the same time, that certain deviations from expected returns are always possible, if not probable.

* * *

ECONOMIC EVALUATIONS FOR INNOVISTIC NEW PRODUCTS*

By John H. Norton
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Engineering economy texts published recently indicate an increased awareness of the importance American businessmen are placing on the speedier application of new technology. However, in contemplating the commercialization of innovistic new products, these businessmen often require answers not supplied by conventional investment and replacement models. Increasing the sophistication of these models does not appear to be a feasible answer. A new approach, perhaps less elegant in evaluation methodology, but more comprehensive in presentation of decision consequences, is indicated.

The purposes of this paper are: to review the typical problems confronting managers of new product ventures; to illustrate the inadequacies of commonly used evaluation techniques; and to suggest that more attention be given to the development of an approach that permits the decision maker to evaluate a broader spectrum of risks and opportunities.

As a framework of reference, consider the life cycle of a typical successful innovistic product (Figure 1). Arbitrarily, this cycle has been separated into five phases: development, introduction, growth, maturity, and obsolescence. Sales volume, during the development phase, is nonexistent, or very small. It starts to move upward during the introductory phase, grows rapidly as the new product meets acceptance, becomes static as the product matures, and finally declines as the product reaches obsolescence and is replaced by some other new product. Often, during the introductory phase, unit price has to be less than unit cost, with resulting negative

*From the author's presentation at the Engineering Economy Division Conference, American Society for Engineering Education Annual Meeting, Purdue University, June 1960.

profitability. However, in later phases this situation is reversed. This results in a period of relatively high profitability, followed by a period of declining profitability, caused by inflation, competition, declining volume, and other factors.

Now consider the question of innovation. Figure 1 shows the effects of innovations that result in completely new products. However, not all innovations are of this type. There are, for example, innovations which result in improved products and improved processes. These types of innovations may improve the picture given in Figure 1 in basically two ways. First, they might open up new opportunities for the product, postponing the time when sales volume declines. Second, such innovations might reduce the cost of operations, extending the period of high profitability. Obviously, any combination of these effects is also desirable.

By definition, when the product enters the obsolescence phase, innovations alone are no longer able to prevent sales-volume decline. Cost reduction becomes the primary target. Typically, during this phase, economic evaluations can be drawn to a fine point. Historical data are plentiful. Evaluations using statistical correlations, mortality dispersions, gradient factors, precise estimates of expected salvage value, and so forth, can be made meaningful.

However, during the early part of the life cycle, historical data are less plentiful. Uncertainty and risk cloud the issue greatly. Analyses which claim to show the significance between 19 per cent return on investment, and, say, 21 per cent return on investment, lose their meaning. In fact, such claims made very early in this cycle may "outrage the businessman's intuition", as Professor Billy Goetz commented in a recent article.[1]

The extreme situation occurs when economic evaluations are used for the initial investment decision, prior to launching the product commercially. At this point the businessman is not apt to be much concerned with refinements such as continuous compounding of interest versus annual compounding. He wants to know: "Where is

[1] "Engineering Economy - Teaching and Practice", The Engineering Economist, Vol. 5, No. 2, 1959, p. 5.

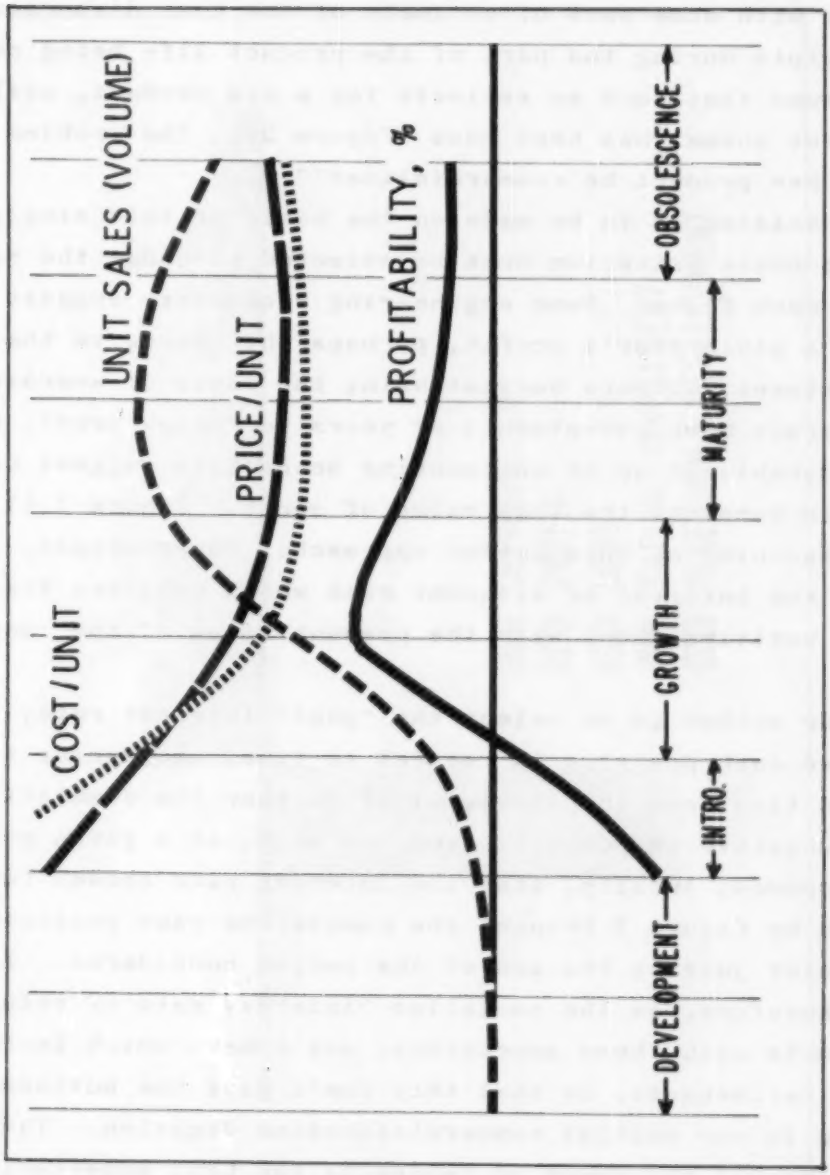

FIGURE 1 - TYPICAL PRODUCT LIFE CYCLE

my greatest opportunity? Where is my greatest peril? What strategy is likely to produce the best results, considering available resources and company policy?"

No matter how sophisticated or plain an economic evaluation is, it must start with some sort of estimate of the cash disbursements and cash receipts during the part of the product life being considered. Assume that such an estimate for a new product, still in the development phase, has been made (Figure 2). The problem is: "Should this new product be commercialized?"

If the decision is to be made on the basis of this single estimate, an economic criterion must be selected to judge the value of the expected cash flows. Some engineering economists suggest using the ratio of a given year's profit, perhaps the third, to the total initial investment. Others suggest using the ratio of average profit to average book investment; or years to "break even", etc.

A considerable group of engineering economists suggest using criteria which consider the time value of money. Figure 3 illustrates the reasoning of this latter approach. In principle, it is to determine the interest or discount rate which balances the present value of the positive flows with the present value of the negative flows.

A similar method is to select the "goal" interest rate, plot the cumulative cash position in respect to time, and decide the merits of the proposition from the viewpoint of whether the cumulative cash position is negative or positive, and how much, at a given point in time. It happened, luckily, that the interest rate chosen for the example shown by Figure 3 brought the cumulative cash position to the break-even point just at the end of the period considered. It is the same rate, therefore, as the so-called "interest rate of return".

The trouble with these approaches, and others which include even further refinements, is that they don't give the businessman much guidance in the initial commercialization decision. They don't, for example, answer the query of "Where is the best opportunity, where is the greatest peril, what is the best strategy?" The businessman, or the decision maker, knows that no matter how sincere and capable the evaluator is, he cannot possibly answer all these questions with a single number, or a single analysis; unless, of

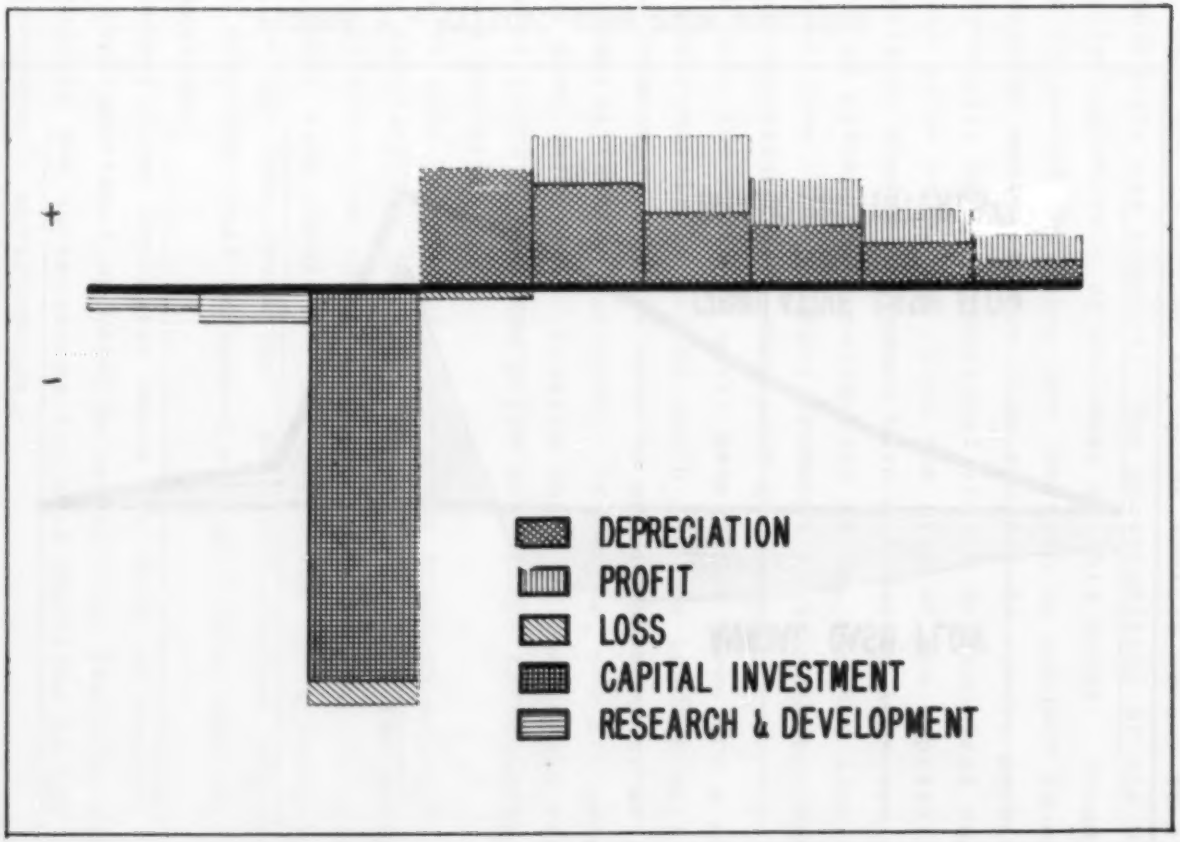

FIGURE 2 - TYPICAL CASH FLOW PATTERN

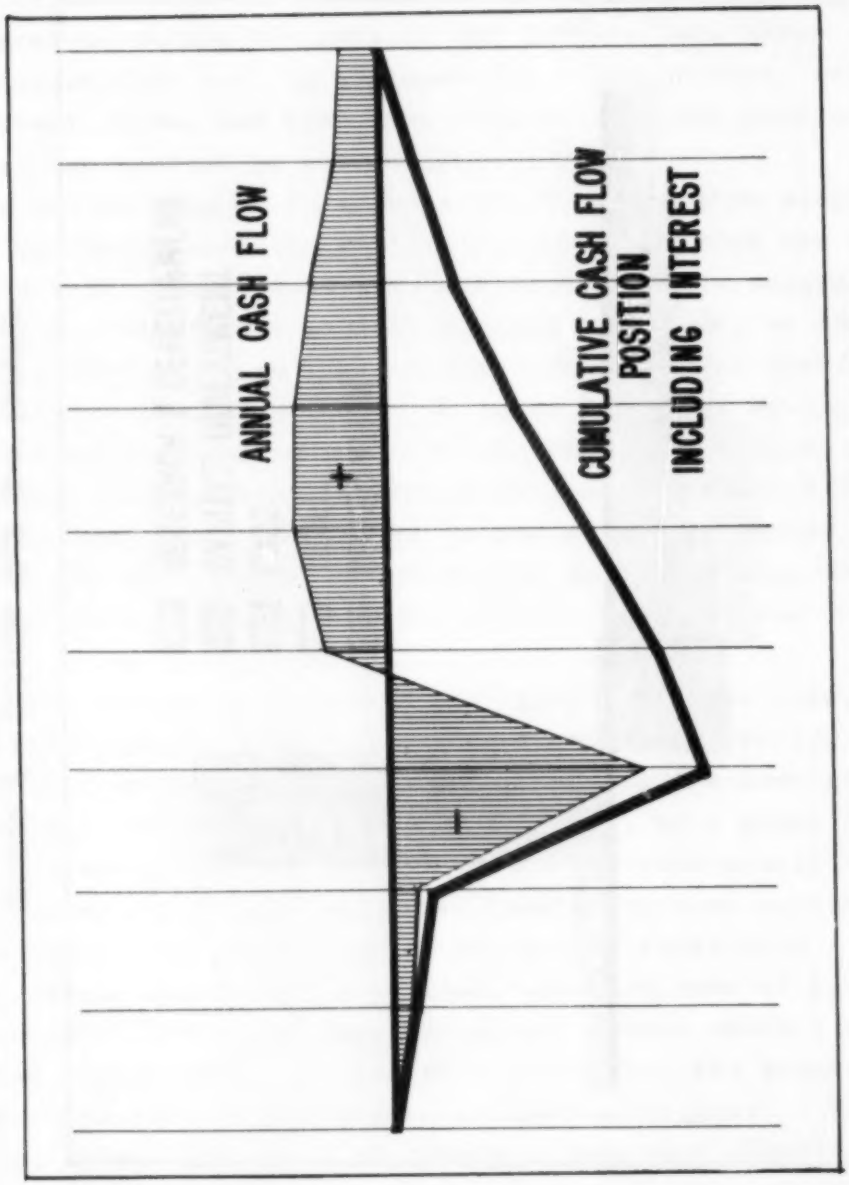

FIGURE 3 - TYPICAL CASH FLOW ANALYSIS

course, the evaluator has already made many of the business decisions. This usually isn't too appealing to the decision maker. He wants to know what happens "if", as well as what happens "when".

Consider some of the uncertainties typically confronting the decision maker who is trying to decide whether or not to commercialize an innovistic new product. The acceptability of the product is usually only tentatively established at this point. Production costs have been estimated, but they are known to be subject to error. Selling-expense estimates are also subject to error, particularly if some unusually heavy promotional effort or technical support is later found to be required. Even the size of the capital investment is in question, though engineers have constantly improved their techniques of estimating construction costs, and the like. Often, price competition from existing products is important. How much will this competition be? When will it occur?

In short, the decision maker knows that there are a number of possible environments in one of which the new product will have to live; environments which are open to major uncertainty at the time of the commercialization decision. Of course, not all uncertainties are of the same magnitude. Usually there is more doubt regarding estimates of sales volume and price than there is regarding estimates of cost and investment.

It must also be recognized that the decision maker is evaluating more than one decision course. He has to decide, for example, to what specification, or specifications, the new product will initially be made. What size should the initial plant or facility be? When should it be put into operation? What introductory pricing policy should be adopted? What personnel are available, and how should they be assigned?

The experienced evaluator knows all this, of course. He recognizes the importance of considering all the feasible alternates, and determining the consequences for each decision in the light of all the foreseeable environments.

Let us assume that our experienced evaluator has done this. For simplicity of illustration, let us also assume that Figure 4 provides analyses for all the possibilities to be considered. There are nine in total, including the one first discussed. These analyses

are all on the basis of cumulative cash position in respect to time, and all use the same interest rate. Obviously, some are much better than the original case, and some are much poorer. But what does the evaluator do next? Does he pick the best of the lot, the worst, the average? Or does he present the decision maker with the entire group?

If one is to judge by much of the literature of engineering economists, the evaluator usually makes a single selection, based on his own "best estimate", then fills out a proposal form, sometimes in great detail, and presents it to the decision maker. The decision maker then accepts the proposal, rejects it, "tables" it, or sends it back for more data.

On two counts this doesn't seem to be a good situation. First, the decision maker shouldn't "pass the buck" to the evaluator in narrowing the nine cases to one; and the evaluator shouldn't assume these prerogatives of the decision maker. Second, it doesn't appear to be necessary, in view of recent advances in decision theory and the advent of high-speed computers which can make many evaluations quickly and economically. An excellent comprehensive presentation of decision theory, and its possible application to business decisions, is contained in a recent text by Robert Schlaifer.[2] Another fine reference is the speech Professor R. B. Fetter gave on the evaluation of uncertainties in inventory control, at the 1959 ASEE-AIIE Engineering Economy Symposium.[3]

If a similar approach is used for the example in this paper, the result is as shown by Figure 5. Consider now how much easier it is for the decision maker to answer his own questions regarding opportunity, risk, and strategy. He can see, for example, that if environment E_2 occurs, decision D_1 provides the maximum opportunity.

[2] Probability and Statistics for Business Decisions - An Introduction to Managerial Economics under Uncertainty. McGraw-Hill Book Company, Inc., New York, 1959.

[3] "The Evaluation of Uncertainties in Inventory Control", Planning and Justifying Capital Expenditures (papers of the Symposium). Edited by Arthur Lesser, Jr. Published by The Engineering Economist, 1960.

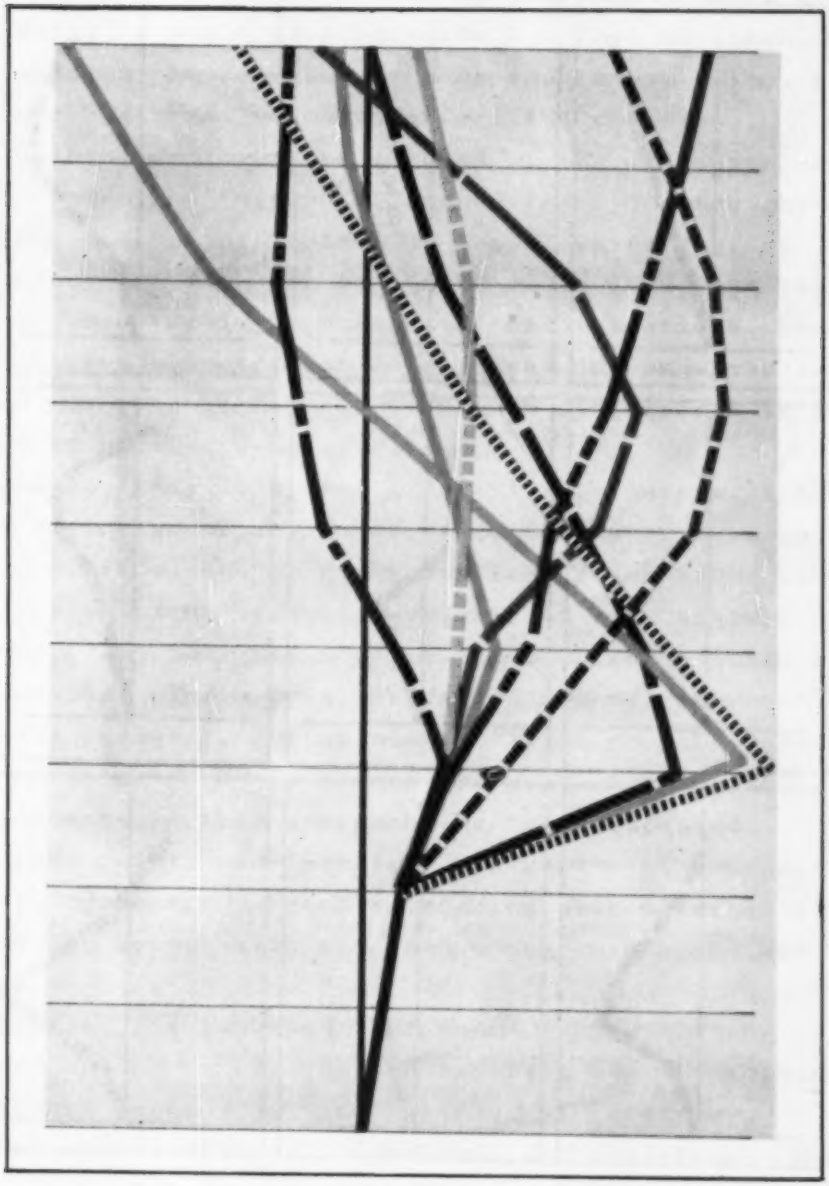

FIGURE 4 - TYPICAL CASH FLOW POSSIBILITIES

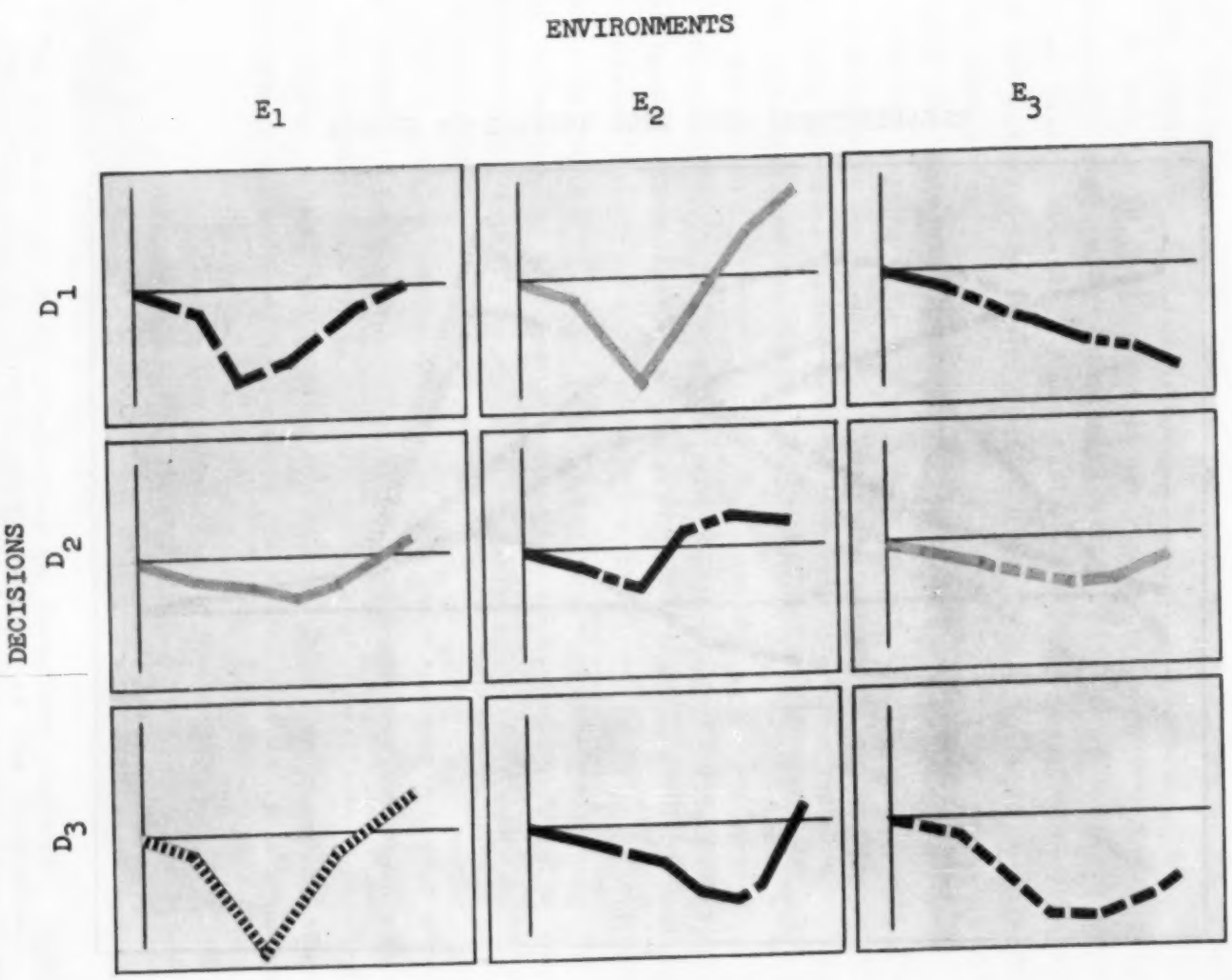

FIGURE 5

However, decision D_1 also results in the greatest loss, should environment E_3 be controlling. If the decision maker feels that environments E_2 and E_3 are about equally likely, and he wants to play safe, he would probably choose decision D_2. On the other hand, if he considers there to be a strong probability that environment E_1 will exist, he might pick decision D_3. And so forth. The decision maker is in command where he should be. Also, he can see just how his business judgments affect the decisions.

Would these decisions be altered if the evaluator had used a half-year convention instead of end-of-year, or straight-line depreciation accounting instead of sum-of-years digits? Certainly hypothetical situations can be contrived to show that they might. However, after reviewing a number of real situations, the author concludes that the uncertainties involved in commercializing an innovistic new product far outweigh such differences in evaluation techniques or accounting procedures.

Of course, this is a very simple little matrix, and doesn't represent a problem of any consequence. However, the point of all this is to confirm some of Professor Lesser's remarks concerning the difficulties of using economic evaluations with new and untried innovations,[4] and to explain a viewpoint which has been helpful in some situations. The matrix, or decision-model approach, is not offered as a cure-all, by any means. It is probable that the problems of using such techniques are just starting to be understood. Many refinements in this approach are to be expected.

A second point, made earlier, and worthy of emphasis, is that, where in-put data are subject to considerable uncertainty, it does little good to spend extra time and money on elegant evaluation techniques.

In summary, it is hoped that considerable further effort will be expended on the perfection and expanded use of decision models in engineering economy, at the expense, if necessary, of further perfections on the traditional investment and replacement models.

[4] In his speech at the Engineering Economy Division Conference, ASEE Annual Meeting, Purdue University, 1960.

DISCRETE VERSUS CONTINUOUS COMPOUNDING - A NOTE

By David V. Heebink
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The various elements that comprise net cash flow have appreciably different frequencies of occurrence. For instance, tax payments and lease (or royalty) disbursements are outlays that may occur as infrequently as once a year. On the other hand, disbursements for labor and receipts from the sale-of-product generally occur frequently enough so that they may be viewed as cash transactions that are virtually continuous.

Most investment proposals entail cash elements that have different relative frequencies. If an analyst were to be entirely realistic in using compound-interest techniques, he would treat each element of cash flow according to its particular time frequency. However, this would hopelessly complicate many problems, and such refinement in technique is inconsistent with the relatively rough estimates that are usually used. In order to simplify matters, one of two conventions is employed. Either cash flow is treated as if it occurred continuously throughout the year and continuous compounding is used, or else cash flow is treated as if it all occurred at the end of a period (usually a year) and compounding is done between these discrete intervals of time.

Since some business organizations use the former convention and other concerns use the latter, the following questions ought to be answered. First, does the choice of a convention make any difference in the computed quantities that are used for making investment decisions? Second, if there is a difference, under what (if any) circumstances does it tend to be most pronounced? Finally, how should a company decide which convention to use?

COMPARING CONVENTIONS

In order to compare the results of discrete and continuous compounding, various situations involving an investment and a resulting uniform, positive, net-cash-flow stream are used below. The effective rates of return for both conventions are calculated for

each situation in the manner indicated. The results are summarized in the following table, which gives the continuous rate of return for various combinations of study period and discrete rate of return.

COMPARISON TABLE

Discrete Rate of Return	4 years	10 years	20 years	30 years
5%	6.3	5.6	5.3	5.2
15%	19.5	17.3	16.7	16.5
25%	34	29.7	28.8	28.6
35%	49	43.1	41.9	41.9

Thus, an investment which yields 5 per cent (effective) over a four-year period, when end-of-the-year convention is used, yields 6.3 per cent (effective) when continuous-flow convention is applied to the same data.

The continuous rates of return were derived by finding the discrete uniform series present-worth factor for each combination of time and discrete return; e.g., for four years and 5 per cent it is 3.546.[1] This is the investment required to earn a dollar per year at the end of each of the next four years at 5 per cent effective interest. Now suppose that the same $3.546 is invested and a dollar per year is earned uniformly during the year. What is the effective rate of return? This can be found in Table E-26 of Grant and Ireson, by selecting the line for a four-year period and interpolating for a continuous present-worth factor of 3.546. The continuous values in the comparison table are rounded off to the nearest tenth of a per cent, and they are subject to the errors of linear interpolation.

The Comparison Table indicates that the convention used does affect the rate of return that is calculated for a given situation. It is clear that both the interest rate and the length of the study period have an effect on the magnitude of the difference between the results of the two conventions. The thirty-year column of the table

[1]See Table E-11 of Grant and Ireson, Principles of Engineering Economy (The Ronald Press Company, New York, 1960).

indicates that the absolute difference increases from only .2 per cent at low rates of return to almost 7 per cent at higher rates of return. When the study period is shorter, the absolute difference between conventions is even greater. For a four-year period, the discrepancy in results runs from 1.3 per cent to 14 per cent.

It seems, then, that the choice of a convention could have an important effect on decisions in the case of projects having a high rate of return, especially if there is heavy cash flow during the early years of its life. In regard to the latter point, it should be noted that the rate of return on a project having a ten-year life, and nearly all of its net positive cash flow during the first four years, will not differ greatly from the rate of return on a project having the same cash flow during the first four years and none thereafter.

SELECTING A CONVENTION

The above information indicates that,in a business which has established a relatively low minimum attractive rate of return, the choice of a convention is not likely to affect capital-investment decisions. However, in a company having a high minimum attractive rate of return, the convention that is used is more important. This is especially true if the proportion of frequent and infrequent cash-flow elements changes radically from project to project. Under such circumstances, consistent use of one convention will mean that some projects are treated in a fairly realistic way, whereas projects having cash-flow characteristics that are not in keeping with the convention will not be treated realistically. This could result in wrong decisions on projects having a calculated rate of return that is just above or just below the minimum. (For example, suppose that a company uses a 20 per cent minimum attractive rate of return and the end-of-the-year convention. Then a project having a prospective rate of return of 17 per cent would appear to be unacceptable. However, this project might be expected to have an unusually large proportion of continuous cash flow during the first few years of its life. If the data were treated more realistically, the solving rate of return very likely would indicate that the project was acceptable. Conversely, the continuous-flow convention could mislead the decision

maker by overstating a borderline rate of return.)

In order to avoid this problem, a business with a high minimum attractive rate of return ought to treat infrequent cash items discretely and frequent ones continuously. A less complicated approach would be to use that convention which best represents the typical proportions of frequent and infrequent cash items. So, if most of the cash flow for typical projects occurs rather frequently, then the continuous-flow convention ought to be used. However, when a marginal, non-typical project is being evaluated, the larger proportion of infrequent cash items should be recognized. This can be done by treating the unusual, infrequent cash elements discretely. Thus the possibility of distortion is minimized. This procedure involves more complicated calculations only in exceptional cases.

* * *

"RETURN ON INVESTMENT - FIT THE METHOD TO YOUR NEED"*
A Review Article

By

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This article should be of interest to engineering economists for a number of reasons. First, because it is a good example of evidence in the current business literature of a growing interest in the use of the principles of engineering economy. Second, because it strongly promotes the use of correct time-value-of-money calculations. And third, because it illustrates, in one compact article, many of the important common sources of confusion about the application of engineering economy.

The author presents "three basic types of return on investment, each designed to meet a different need of evaluation". Each is defined as a ratio.

1. Operating return -- "the ratio of operating profit to the (value of) the assets employed in earning that profit".
2. Cash return -- described as "the ratio of cash income to cash invested". (This later develops as the true rate of return as defined in engineering economy texts.)
3. Equity return -- the ratio of earnings of an enterprise to the book value of the common stock, both determined "by standard accounting practice".

EQUITY RETURN RATIO

This ratio is of course well established as a traditional planning and control statistic, informative and useful to investors, management, and others as a consistent, periodic, historical measurement of over-all operating results. The only unique suggestion

*EDWARD A. RAVENSCROFT: Harvard Business Review, March-April, 1960. (Vol. 38, No. 2)

of this author is that compound-interest discounting should be used in determining multiperiod averages of this ratio; and this idea is clearly unsound.

CASH RETURN RATIO

Under this banner the author promotes Reul's after-tax cash-flow analysis and rate-of-return calculation, using continuous-compounding present-worth factors. The examples presented are properly cases involving decisions between future courses of action, and the analyses are technically correct. However, there are several consequential flaws in the descriptive text:

1. Confusion of economy-study and (historical) accounting ideas, leading to unnecessary sunk-cost thinking and the suggestion that operating differences between the alternatives should be "determined by regular accounting procedures".
2. Unsophisticated suggestions concerning the use and interpretation of a prospective rate of return on a proposed project.
3. Statements implying that the rate-of-return method of comparison has a very narrow range of application.
4. The apparent suggestion that it is useful and practicable to compute historical rates of return for segments of an enterprise, and to reconcile such calculations with both accounting figures and with rates of return computed for use in making decisions about proposed new investments.

APPLICATION OF "CASH RETURN" TO BUY-OR-LEASE DECISIONS

Two of the examples illustrating rate-of-return comparison treat the same proposed project, first assuming the equipment is purchased (Exhibit V), and then assuming the equipment is leased (Exhibit VI). The second analysis is of course misleading and not appropriate, because, in the situation described, the two questions, "Shall we undertake this project?" and "If so, how shall we finance it?" are separable decision problems. Although the third "cash return" example (Exhibit VII) does treat a lease-versus-buy question properly as a separable decision between alternatives of finance, the author fails to point out that wrong conclusions may be reached if two separable decisions are treated as if they were inseparable,

and vice-versa.

OPERATING RETURN RATIO

This is essentially an accounting-based ratio aimed at measuring "operating efficiency" in terms of the "profit" productivity of capital employed in segments of an enterprise. The numerator is "profit" in the accounting sense (after depreciation, before taxes). The denominator is the original cost value of assets employed, including "fixed assets, inventories, and receivables" (regardless of ownership and financing arrangements).

Because the calculation of the numerator involves depreciation in the amortized-cost sense, the author here discusses depreciation accounting. In this connection he uses some poorly-chosen phrases such as "set aside an amount" and "cash used to cover depreciation", which are at the least unfortunate.

This "operating return ratio", like the "equity return ratio", is a historical measurement of operating results. It is a possible periodic output of an administrative data-processing system, potentially useful as information of value in a variety of planning and control functions. Such a statistic does not, like rate of return, represent a summary of an analysis of future differences between alternatives, and would be useless (or badly misleading) with respect to economy decision problems. Unfortunately, the example presented in connection with "operating return ratio" involves precisely the kind of problem for which this "ratio" is <u>not</u> appropriate -- a comparison between two future courses of action.

At this point, the author apparently abandons his suggested "operating return <u>ratio</u>", and substitutes what he calls an "<u>average</u> operating return" -- which also is not appropriate as a decision guide, and yields quite misleading results. If applied to specific decision-making problems, this "average operating return" has no clear interpretation except as a biased (understated) approximation of the prospective rate of return before taxes. The bias is inherent in deducting straight-line depreciation in arriving at the annual cash-flow figures, and then adding back the sum of such depreciation at the end of the assumed service life. Incidentally, this "<u>average</u> operating return" is not an average in the ordinary

sense -- it is time-adjusted.

The basic source of confusion here lies in attempting to utilize the compound-interest discounting and cash-flow techniques of engineering economy for computing what probably is intended to be a managerial control statistic. This is further compounded by the implication of the example (and numerous statements) that this calculation is appropriate for evaluating proposed investment "projects" -- which it most certainly is not.

AVERAGE RATE OF RETURN

Prior to discussing the "three types of return on investment" (and in two appendices), the author develops the compound-interest theory behind the present-worth discounting calculations used in computing rates of return. Basically, the presentation is sound. However, the author's discussion is unnecessarily confused by introduction of the concept of the rate of return as an <u>average</u>, and by the use of accounting ideas and terms. Particularly, the use of the term "average rate of return" is unfortunate, because of the likelihood of confusion between the correct rate of return and one or another of the so-called rates of return (such as "average book profit"), which have no clear interpretation.[1]

The algebraic manipulations presented in Appendix A are correct, but tell us only the following: If two sets of sums consisting of amounts located in time at different dates are equivalent to each other at a given interest rate, their equivalence can be demonstrated by time-adjusting the sums in each set to the same date. Clearly, it does not matter what date we choose to adjust them to, so that they may be added and compared. As an alternative, their equivalence could be demonstrated by converting both sets to an equivalent uniform annual series over the same time period.

The "simplified equation" manipulations in Appendix B will be recognized as elementary exercises in the mechanics of time-value-

[1] See Grant and Ireson, <u>Principles of Engineering Economy</u>, 4th Edition. The Ronald Press, New York, 1960. Pp. 177-178.

of-money calculations. However, they do demonstrate a point on which there is considerable confusion in current literature: the ratio of annual net receipts, minus disbursements, to original investment is a meaningful rate of return only in cases for which the following assumptions are reasonable estimates of future events.

- Investment occurs at date zero (only).
- Net income (or savings) minus disbursements will be the same each year.
- Either the salvage value expected at the terminal date is equal to the original investment, or the useful life is very long (infinite).

Incidentally, this appendix seems to "prove" that a rate of return is a ratio -- which it generally is not -- and thereby develops, between rate of return and the author's "operating return ratio", a similarity which is of course synthetic.

CONCLUSION

Among the many sources of confusion illustrated by this article, the following seem to be the most noteworthy:

1. Failure to distinguish between two vastly different administrative processes -- managerial control and economy decision making.
2. Attempting the futile alchemy of reconciling estimates and calculations appropriate for one of these purposes with those appropriate for the other.
3. Misapplication of both accounting concepts and principles of engineering economy, and confusion between the two.

On the positive side, this article, by an industrial executive, should help to promote understanding of correct time-value-of-money calculations and cash-flow analysis.

A SUGGESTION BY THE REVIEWER

Reprints of the article might very usefully be employed in connection with an advanced course in engineering economy, as the basis for either a one-hour discussion or a term-paper analysis.

THE CARELESS REVOLUTION
A Review Article

By
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Anyone unfortunate enough to live "in the presence of history" will find himself, on occasion, aghast at the lack of preparedness, the folly, or the villainy of those in power. Having some humility, however, he will comfort himself at times with the thought that the Top People must know what they are doing. Then, some years later, someone who had close contact with certain events writes a book which shows all too clearly that this assumption was unwarranted. Governments, in short, get the benefit of a lot more doubt than they deserve. Mr. Kelf-Cohen's book* is a fine example of this mellow literary tradition.

The author, formerly a British high civil servant, gives a detailed and sound account of the nationalization of coal, electricity, gas, transport, and iron and steel in Britain, by the Labour Government, in 1945-1951, and the experiences of these industries thereafter. However, he also tries to prove a theory. The book is subtitled "The End of a Dogma", the dogma being the political principle of common ownership espoused by the Labour Party. It is Mr. Kelf-Cohen's view that this part of the Labour program is not now a viable political idea, in the sense of getting people to vote for it, though it was responsible for the nationalizations carried out. Certainly, this view is reinforced by the current controversies in the party, over nationalization (the "Clause 4" affair), following another major electoral defeat. Yet the image of its being led astray by dogma, and now reforming, is much too simple an explanationof what has happened. Insofar as this suggests to other British industry that the danger is now over and business may be done at the old stand, it is actually misleading. A review of these matters

*R. KELF-COHEN: Nationalisation in Britain. The Macmillan Co., London, 1958. St. Martin's Press, New York. $5.50.

is important, especially since corresponding American industries have experienced problems similar to those of the British, though, of course, they retain their private character.

What emerges most clearly is that the Planners had no plan, that it was a case of "muddling through", of "flying by the seat of one's pants", or, in the more elegant phrase of the author, of "solvitur ambulando". The elevation of this type of pragmatism into a national virtue is sometimes overdone.

In trying to establish his theory, the author starts with some questionable ground rules. He talks only about the five industries nationalized after 1945. But why ignore the other nationalized British industries, such as the BBC, telephones or airlines? These are private elsewhere. The author pleads their novel character, but does this mean that only old, decrepit industries should be nationalized? Moreover, these other activities were established or taken over during Conservative and Liberal Governments, and had nothing to do with socialist dogma.

This leads us to the second point, that the major non-communist nationalizations in Europe, even of the same industries discussed by the author, were carried through by conservative governments, if not, in early years, by autocratic monarchies. By the 1860s, most continental countries had state railroads, and they were gradually increased until they made up the bulk of the mileage. By 1937, Britain was the only country in Europe in which the railroads were entirely private.

Most of the continental railroads were taken over simply because they went bankrupt, and this was a service which had to be maintained in the interest of the state. Many lines were built, in part, for strategic reasons, and their traffic potential would remain low for many years. The government furnished the capital, and retained control over the finished lines, as was not done in the case of the American land-grant railroads.

In France, one system was nationalized long ago (Etat). Money troubles beset the other lines in the depressed 1930s, and, finally, a succession of accidents traced to poor controls; the one at Lagny in 1936, claiming 300 lives, led to successful demands for nationalization. The French lines have since had to be virtually rebuilt

as a result of war, and have turned into the most technically advanced in the world.

Other examples include the coal mines of Holland, nationalized in 1901, and the power grids of many European countries, built because the utilities didn't want to do it. Interestingly, fear of a government takeover is cited as a reason for the opposition of many American utilities to greater power interlocks. It is surprising that the author ignores all these nationalizations,by respectably capitalistic governments, in his strictures against the Labour Party.

The facts of the case seem clear. There were some books at the beginning of the century, notably by Sydney Webb, which served as the theoretical underpinnings of nationalization, from the Labour, or Socialist, viewpoint. In those works, all the major problems involved in running a public monopoly appear at least to have been pointed out, though it was beyond the state of managerial science in those days to solve them. Indeed, many still remain points of controversy. However, no attempt seems to have been made to solve the problems during the forty years or so before the Labour Party took office with an adequate majority.

The author relates that, when Mr. E. Shinwell became Minister of Fuel and Power in 1945, he found that no preparation had been made for nationalization. "There was no blueprint ... even a faint one." This does not seem the action of political dogmatists, who, if nothing else, usually come up with an impressive and detailed array of Procrustes' beds. The British Labour Party has, in fact, generally ignored its intellectuals, a policy which probably reached its peak in the behavior of Mr. Ernest Bevin as Foreign Secretary.

The importance of dogma in the whole development is therefore easily exaggerated, and one must beware of taking ringing declarations in party platforms for any deep thinking as to how such policies are to be carried into effect. Actually, in his account of events after nationalization, the author himself points to a number of important factors which have caused matters to come to their present pass. Where we may differ from him is in his inference that these things resulted in some way from nationalization itself, with the blame placed squarely on socialist dogma.

This is strongly underlined by the fact that the Conservatives

did not disturb the nationalized industries except in two respects, even at the risk, as Sir Winston Churchill eloquently put it, of "blurring the lines of party recrimination".

Why, then, were just these industries nationalized? Why not automobiles, chemicals, retail trade or machine tools? The reason seems to be that all five had got themselves in very bad odor with the public by their policies between and, in part, during the wars. There should be no doubt that, in 1945, nationalization set well with a considerable majority of the voters, and the desire to give assorted villains their "comeuppance" was powerful indeed. However, nationalization was carried out under much-changed economic conditions, and the result was that all kinds of difficulties developed which should have been thought out. In particular, these were concentrated in aspects of management, control, and public supervision, where market changes, past resentments, neglect, and basic deficiencies in the national educational systems combined to make successful operation very difficult. In short, problems were such as any business might have to face but which it might be difficult to ask a private investor to tackle.

In market changes, the worst problems were faced by coal, gas, and railroads. England depends on manufactured gas, made in many small plants, not infrequently well-preserved centenarians. The industry was re-equipped and consolidated in many areas, but the change to electricity continued and there was no heating and appliance business to increase revenue.

There were critical shortages in coal right after the war, in part due to inability of the railroads to distribute what coal <u>was</u> available. Output of coal has remained static, or declined, over the years; there has been much conversion to oil -- which must be imported. In addition, the increasing mechanization has tended to reduce the handpicked quality of the coal, especially the "large coal" beloved of British householders for their fireplaces. The author, on the one hand, lambastes the Coal Board for not improving the quality, and on the other hand for not trying to educate the British away from a method of home heating which would have seemed archaic to the Roman army of occupation almost two thousand years ago. Even pot-bellied stoves fed by coke (of which there seemed to be plenty, even during

the war) never caught on much. Until the present European coal glut, the Board still was unable to produce enough, and quantities to individual householders are still restricted. Yet, as we will show, there simply was no way in which the prewar way of working could have been resumed.

It will not surprise any American that the British railroads had their share of market troubles too. The British network, about one-tenth the size of the American, was made up before 1921 of some twenty major lines. They were then amalgamated into the four groups which were ultimately to be nationalized. The legacy of original lack of planning is still evident in a spaghetti-like profusion of non-coordinated lines in many areas and such survivals as London's fifteen railroad terminals. Not that similar criticism could not be levelled against some American regions. However, people the world over have responded to this and similar inconveniences by the use of individual vehicles which may cost less to run. Public passenger transport has been forced to retreat before a wave of bicycles, scooters, small cars, and so on, up to the lordly locomotives of Detroit.

British passenger trains have not suffered as have the American. Bradshaw's Guide of the British lines is now fatter than the American Official Guide, and must contain many times more trains -- even though they still don't run on Sundays in many parts of the country (this in itself is probably a serious drawback, for people who buy themselves vehicles at first for week-end use only will ultimately tend to use them throughout the week also). Whenever such market contractions result in train cuts or the closing of a branch line, public indignation rises and the deterioration of service begins to feed on itself.

At the same time, of course, there had been a loss in freight to the long-distance truckers; and the original and not unworthy objective had been to coordinate all common-carrier transport in a single policy program.

Here, it does not seem to have been realized that road investment programs, truck, license, and gasoline taxes are simply matters of politics, and that it is up to a country to decide whether or not to let its railroads decay. Switzerland, Japan, and the USSR, for example, have made definite efforts to help their lines by restricting

competing means of transport. To talk of all railroads as obsolete is economic nonsense. They remain the cheapest, and by far the safest, means of universal transport in terms of manpower and energy expended. The costs of the alternative road complex are borne by the community at large, apparently quite happily, for large road-building programs remain politically popular, their "pork-barrel" aspects easily outweighing increasing local objections.

The British railroads were technically backward to quite an extraordinary degree, for a system which, prior to World War I, had certainly the most comfortable trains in the world. However, the wooden freight cars had no through brakes whatever, and vacuum, rather than pressure brakes were used elsewhere. British freight trains therefore bang and clatter along at a fast twenty miles per hour, the cars coupled by means of hooks and chain links. Piggy-back had been introduced before World War II, but the road-end of the "door-to-door containers" was still partly handled by horses. Electrification and dieselization were both negligible compared with the great schemes under construction or operating on the Continent.

Similar backwardness existed in the coal mines. There was little machinery and pit ponies were still widely used before the war. The National Coal Board was partly able to remedy this, at great cost but with functional success, in spite of all the old arguments about seams being too narrow, etc.

Most critical of all, however, especially in the coal industry, was an extremely bad labor situation, born of decades of resentment. It reached a peak in the British General Strike of 1926. This was caused by the desire of the coal owners to cut wages; and the railway workers, the printers, and a few other unions struck in sympathy. The strike was broken and the highly punitive Trade Disputes Act of 1927, together with the bad settlements which the miners, the railwaymen, and others had to accept, left a legacy of bitterness which made the men look to political action, i.e., nationalization. Lord Birkenhead, the man who, together with Churchill and Chamberlain, broke the General Strike, once said[1] that he thought the miners'

[1] J. Symons, The General Strike. Cresset Publishing Co., London, 1957. P. 47.

leaders the most stupid men he had ever met, until he met the owners. The author almost ignores the great importance of poisoned labor relations in some of these industries.

Steel was in a similar situation. During the slump of 1920-1921 the companies consolidated and many plants were scrapped. "Ghost towns" resulted. Among others, the only British wide-flange beam mill was destroyed. Some of the scrap iron in the plants went to Germany and Japan, and the industry had cartel arrangements with these countries (this was well remembered during the war). Prices were, of course, regularly fixed, even on fabricated structures. Today the industry stresses its expansion program and the loyalty of its workers, in its institutional advertising -- perhaps the manifestation of a delicate conscience. The steel plants are of course mostly private again, though tightly regulated by a control commission.

What did the British governments, Labour and Conservative, do about all these problems? Mainly, they invested a lot of money, especially in the electric utilities and the coal mines. The author's main complaint is that it was too much and that members of Parliament and civil servants, classicists all, could not understand the reports of the engineers. Thus:

> "The Ministry of Power has no mining and electrical engineers, ... nor has the Ministry of Transport a staff of railway engineers ... "

This shocking state of affairs goes right to the familiar status questions of the engineer and scientist in the West. The problems of these industries could only have been solved by good technical experts, supervised by competent judges. Otherwise, "Quis custodes ipsos custodiet?", or, as Jacques Barzun has translated it, "Who shall fling custards at the custodians?" The consumers were even more helpless, and the parsimonious civil-service-type salaries discouraged men from making their careers in the industries, and even from serving on the Boards. In general, the rabbits were left in charge of the vegetable garden. That this is not inevitable is shown by the much better organization of the French nationalized industries, or, for that matter, by the fine technical staffs of many American regulatory agencies (though not always by the Commissioners).

There is, lastly, a still lingering resentment among the workers

who have long memories. The railwaymen are poorly paid, and so there are frequent strike threats. The miners have resisted attempts to import reinforcements in labor-short areas[2]. The more capable men in the electric utilities go to the manufacturing firms. Nevertheless, under full employment, and free choice of jobs, little can be done about this.

This story gives little comfort either to dogmatic advocates of free enterprise or of nationalization. Free enterprise let things come to their pre-1945 pass and a Conservative government did not disturb any industry in which the nationalization was completed. Labour had no adequate plan and could not deal with the managerial problems they found, even though they were largely foreseen by their own theoreticians -- "dogmatists", if we prefer. Finally, the author's own conclusion leaves little doubt that government financing was indispensable.

This raises important questions for some of the corresponding American industries. For example, if a railroad asks for a subsidy in the form of property-tax abatement, because it is a community service like roads and sewers, can't any local enterprise claim that it too is a service because it gives local employment? How much in public funds can be given to a particular firm without government's sharing control? Such questions stirred enough controversy to defeat a recent proposal for commuter-railroad subsidies in New Jersey.

However, a community cannot afford to let an essential service die. The author says that industry cannot operate with a threat of "Behave yourself or else" hanging over it. But isn't there a risk of failure in all businesses? Is it nobler to liquidate and send for the wrecking crews than to give somebody else a chance to run things? After all, our bankruptcy laws are designed in part to keep things going until, Micawber fashion, "something turns up".

If a service is held to be essential, then it must be organized and paid for in a politically feasible manner, if not by one alter-

[2]See, for example, C. Sigal, Weekend in Dinlock, Secker and Warburg, London, 1959.

native then by another. The British experience shows that the change of ownership came about in those industries which had allowed their functional deficiencies to get out of hand. The lesson then seems to be that these must be effectively tackled and that arguments about the role of dogma or, for that matter, anti-dogma, cannot be substituted for this. A management which ignores the fact may well find itself in the situation of the driver

> " ... who died maintaining his right of way.
> His right was clear, his will was strong,
> But he's just as dead as if he'd been wrong."

• • •

"ENGINEERING ECONOMY"*
A Review

By

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A book reviewer must answer two major questions about the work he reviews. These are "What is the objective of the book?" and "How well does it accomplish this objective?"

According to Professor De Garmo, his "Engineering Economy" has a primary and a secondary objective. The first is to be a textbook for senior students in Engineering. The second is to be a source of information and a reference work for the practicing engineer. The practicing engineer may never have had formal training in engineering economy, or the inexorable process of forgetting may have gradually stolen whatever he once knew of this vital subject. As the author himself admits, no book can serve two divergent purposes equally well. In this case, the textbook use is paramount, and the book has been written primarily for the engineering student.

How well has De Garmo's book accomplished its objective? Unfortunately, we have not had time since publication to apply the ultimate test -- actual use by students in a classroom course. In place of a field trial, we must imagine ourselves in the students' place and use our experience to evaluate the book. In this reviewer's opinion, De Garmo has accomplished his purpose very well.

The coverage of engineering-economy topics is excellent and logically developed. The author has used approximately one example, chart, or graph for every two pages. In our experience, students learn much more easily from books with specific examples and detailed development. Most engineering students and practicing engineers (in fact most people) find abstract exposition, unillustrated by example, very difficult to follow. Professor De Garmo's

*E. PAUL DE GARMO: The Macmillan Company, New York, 1960. 3rd Edition. 580 pp. $8.75.

book is written in a clear, lucid style which results in a very satisfactory tool for learning Engineering Economy.

Another good feature of Professor De Garmo's approach is the presentation of various commonly used assumptions and methods of engineering economy. It is vitally important for the student as well as the practitioner to understand different methods and points of view in the field of engineering economy, even though the methods may yield divergent results and be mutually exclusive.

A difficult problem in writing any book is selection of material to be included and, even more important, material to be left out. Professor De Garmo has chosen well and included what is essential, and eliminated redundant, unrelated or unimportant topics. Intangibles, taxes, public-utilities analyses and governmental projects are covered.

In this reviewer's opinion, the area of market analysis and product demand deserves much greater attention. Our research and subsequent experience shows that the key factor in most engineering-economy analyses, and consequently the more desirable starting point, is the market analysis. If a product cannot be sold, choice between production methods is immaterial. If the market prediction forecasts a marked increase in sales, the major question becomes "How do we make it?" instead of "Shall we make it?" The demand for the product is a vital factor in any engineering-economy decision and should be discussed more extensively.

The practitioner can find topics of value in De Garmo's "Engineering Economy", although the discussion is aimed at the student and consequently has considerable material of little interest to the practicing engineer. On the other hand, the author includes excellent examples and discussions on modern engineering-economy methods. These can readily be used as reference material by an engineer interested in a specific topic.

In summary, Professor De Garmo has produced a useful, well-written book on Engineering Economy. It is easy to follow and covers the subject well.

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"THE MANAGEMENT OF CORPORATE CAPITAL"*
A Comment

By

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A comment or two is called for, I believe, concerning an implication left hanging by Ezra Solomon, as editor of a group of essays in "The Management of Corporate Capital", and driven home by Richard B. Maffei in his review of the book in the Spring (1960) Engineering Economist. The implication is that, when it gets down to specific cases, the corporate economist, financial consultant, or analyst cannot provide much concrete assistance to the high-level manager in his obligation to make pragmatic decisions. In reviewing this book for The Engineering Economist it was, in fact, the judgment of my good friend Richard B. Maffei that "the greatest service he [Ezra Solomon] has performed is to show us that we really cannot tell businessmen what they ought to do".

This does not seem to me either a particularly healthy or accurate conclusion to draw from a confrontation of the varying and often opposing views represented in this collection of essays. It must be granted, of course, that all of the topics represented in this collection are in the high-priority decision category for any alert management. And it is true that in each of these areas legitimate controversy persists on some very fundamental points.

Nevertheless, the experts who debate these issues (i.e., cost of capital measurement, criteria for investment-decision making, etc.), I submit, are not -- as was said of the Cabots and Lowells -- talking only to one another and to God. In my opinion, the experts are telling management what they ought to do. It may well be that precious few high-level managers themselves read what the experts say, and fewer still are able to follow the esoteric mathematical or

*EZRA SOLOMON: The Free Press of Glencoe, Illinois, 1959. 327 pp. $7.50. Reviewed by Professor Richard B. Maffei in The Engineering Economist, Vol. 5, No. 4, Spring 1960.

other technical arguments which the experts present in their writings.

Nevertheless -- and this is basically my point -- there are in most (particularly larger) companies those who do follow the arguments represented in Solomon's collection and who do strive to implement the fundamentals which they stress. And it is this group in the business world which gets the message, so to say, through to Garcia. The detailed arguments concerning technicalities are unimportant for management, but they matter to the analyst who is responsible for feeding, to management, information and data upon which ultimate decisions are made.

As an economist from the academic world who has in the last few years worked closely with analysts who must deal with investment alternatives, capital budgeting, profitability, and so on, it is clear to me that the better analysts keep up with these debates and strive to implement the basic lessons which experts (as, for example, Joel Dean) have taught.

To be realistic, of course, the analyst or economist cannot guarantee that, for example, in applying certain techniques for measuring the profitability of an investment alternative, he is offering management error-proof criteria for decision making. But in applying the basic techniques conveyed in these essays, irrespective of differences in views with regard to points which are not basic, the analyst is able to and does offer methods of ranking investments or measuring capital cost which in the long run will result in fewer mistakes and less loss of profit than would prevail in the absence of this knowledge. It was from reading the experts that business analysts came around to using, much more frequently, the profitability index, rather than pay-out, as a criterion for ranking investment alternatives. The fact that troublesome problems exist with regard to multiple rates of return, and with the snarls suggested in the Lorie and Savage and in other articles of this collection edited by Solomon, does not negate the fundamentals.

The point is that far fewer errors are made by management, with use of these techniques, than would be made in their absence. The habit itself, now widespread, of thinking in terms of the cost of alternatives, may largely be attributed, in its adoption by management,

to the analysts and economists who are "up" on these discussions. It is perhaps equally true, of businessmen, what Lord Keynes said of practical men everywhere who believe themselves exempt from intellectual influences -- that they are all au fond indebted to some theorist (defunct or otherwise), and that "the power of vested interests is vastly exaggerated compared with the gradual encroachment of ideas".

In a word, the experts, through the agency of the interested analyst and economist in business, are,on certain specialized topics of this kind, telling the businessman what he ought to be doing. And in telling him, the experts and analysts are giving the businessman, not, to be sure, the path to riskless certainty -- for that is not to be had in this life -- but a measure of confidence in decision making which otherwise would be unavailable to him.

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NOTES

CHANGE IN PUBLISHING SCHEDULE

The Engineering Economist, with this issue, is regularizing its publishing schedule by identifying this issue (Volume 6, Number 1) as the "Fall 1960" number rather than as the "Summer 1960" number. There is, therefore, no "Summer 1960" issue. This present issue is, however, the regularly sequential volume and issue number, and all subscriptions will continue to cover four copies of the journal; no subscriber will miss an issue or receive less than the actual number of issues covered by his purchase order. We are, in effect, arranging for our publishing schedule to begin in the fall, to coincide with the beginning of the college year; and we hope that this adjustment will not inconvenience any of our readers.

GUIDE FOR COMPANY LIBRARIES

Special Libraries Association has just published a specialized reference tool entitled A Checklist for the Organization, Operation and Evaluation of a Company Library. The 64-page booklet sells for $2.00. Write to Special Libraries Association, 31 E. 10th Street, New York 3, N.Y.

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"AN EXTENSION OF AVAILABLE INTEREST TABLES" (42 pp.)

These interest tables were published in Volume 5 of The Engineering Economist, and are now available in reprint form, at the following prices: 1 to 25 copies, $1 each; above 25, special rates.

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Copies of "Planning and Justifying Capital Expenditures" may still be obtained by writing to The Engineering Economist. See page 44 for order form, and page 45 for news of the next Symposium.

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The Symposium is now being planned to precede the 1962 Annual Meeting of the American Society for Engineering Education, scheduled for June 18th-22nd at the United States Air Force Academy.

THE ENGINEERING ECONOMIST will be happy to pass on, to members of the Planning Committee, any communications from our readers containing suggestions for the agenda. Announcements and news of the Symposium will appear in later issues.

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1962
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The suggestions below were submitted by

NAME: _____

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